

REVIEW OF THE GENUS *MENGENILLA* HOFENEDER 1910
(STREPSIPTERA: MENGENILLIDAE), WITH DESCRIPTION OF A NEW
SPECIES FROM MADAGASCAR

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Abstract.—The genus *Mengenilla* Hofeneder 1910 is considered the most primitive, extant group within the Strepsiptera. With the description herein of *Mengenilla leucomma*, n.sp., from Madagascar there are 19 described species included in this genus, ten of which are now considered valid. However, there is some question as to the status of several species that have been placed previously as synonyms of the type species *Mengenilla chobauti* Hofeneder. Many of these questionable species are linked by their sharing a common host, but there are considerable differences in some characters. This problem is discussed but currently cannot be resolved because of the lack of specimens available for further analysis. The species and history of the genus are reviewed and many characters are illustrated. A revised key is provided that includes all currently recognized species.

Key Words: Mengenillidae, *Mengenilla*, key

Strepsipterans in the genus *Mengenilla* Hofeneder 1910 are part of what is considered the most primitive extant family, Mengenillidae (Kinzelbach 1991, Pohl 2002). Mengenillidae includes the only living strepsipterans whose adult females, as well as adult males, are free-living. Additional plesiomorphic characters include five-jointed tarsi, inwardly directed mandibles, a round head capsule, presence of abdominal stigmata, adult female with only one genital opening, and adult male with a straight aedeagus (Kathirithamby 1989).

The genus *Mengenilla* and family Mengenillidae were proposed by Hofeneder (1910) for a new strepsipteran species collected in Algeria by Dr. A. Chobaut. Since this original description, an additional 16 species and one subspecies have been named. Eight of these

species and one subspecies were synonymized with *Mengenilla chobauti* Hofeneder 1910 by Kinzelbach (1970). This, and subsequent descriptions, resulted in nine recognized species prior to the species described herein.

Little is known about the biology and natural history of any *Mengenilla* species. Males are known for all currently recognized species, but females have been described for only two species. Larvae also are known for only two of the presently recognized species. The host of only two *Mengenilla* species has been discovered; *M. chobauti* utilizes *Ctenolepisma ciliata* (Dufour) (Thysanura, Lepismatidae) (Silvestri 1941b, 1943) and *Mengenilla parvula* (Silvestri) utilizes *Ctenolepisma michaelsoni* Escherich (Silvestri 1942, 1943). It is presumed that all other species in *Mengenilla* use

thysanurans as hosts (Kathirithamby 1989). Silvestri (1943) provided some information on the developmental stages of *M. chobauti*, which he had described as six different species (these were later synonymized by Kinzelbach (1970)). Silvestri (1940, 1941a) also documented observations of reproductive behavior. Parasites of *Mengenilla* have been documented by Kinzelbach (1969), who found a mermithid nematode parasitizing the male imago of *Mengenilla parvula* Silvestri 1941; and Silvestri (1943) described a hymenopteran hyperparasite, *Lochites gregarius* (Torymidae), parasitizing *Mengenilla quaesita* Silvestri 1933 (= *M. chobauti*).

Genus *Mengenilla* Hofeneder

Mengenilla Hofeneder 1910: 34. Type species: *Mengenilla chobauti* Hofeneder 1910: 34, by monotypy.

Austrostylops Lea 1910: 514. Type species: *Austrostylops gracilipes* Lea, original description (location of type unknown). Synonymy by Silvestri (1946).

Tetrozocera Pierce 1918: 428. Type species: *Tetrozocera santchii* Pierce, original description (type deposited in the National Museum of Natural History, Smithsonian Institution (USNM No. 21434)). Synonymy by Silvestri (1933).

Mengenillopsis Hofeneder 1926: 56. Type species: *Mengenillopsis theryi* Hofeneder, original description (type deposited in The Natural History Museum, London). Synonymy by Silvestri (1943).

Hofeneder (1910) recognized that his newly described genus was related to the genus *Mengenea* (Menge), in the family Mengeidae Pierce (1908), but distinctly different enough to place it in a new family, Mengenillidae. Major visible differences are that members of Mengenillidae have a six-segmented antenna, as opposed to seven in Mengeidae; the

prementum is fused to the hypopharynx in Mengenillidae, but free in Mengeidae; and Mengeidae have a cell in the wing formed by MP + CuA and the front branch of MA is absent, with this branch present in Mengenillidae. Lea's (1910) description of *Austrostylops* was published in the same year, but after that of Hofeneder, giving Hofeneder's genus name, *Mengenilla* (and family name, Mengenillidae) priority. However, it is interesting that Lea had collected his specimens in 1895 but did not describe them until after he read Pierce's (1909) monograph of the Strepsiptera. Hofeneder (1926, 1928) described the genus *Mengenillopsis* for two new species, *Mengenillopsis theryi* and *Mengenillopsis mauretunica*, but these were later synonymized with *M. chobauti* making the genus *Mengenillopsis* likewise a synonym of *Mengenilla* (Silvestri 1943). Other genera in Mengenillidae include *Eoxenos* Peyerimhoff 1919 and *Congoxenos* Kinzelbach 1972, both of which differ from *Mengenilla* by lacking a flabellum on the fifth antennal segment.

Diagnosis of *Mengenilla*.—Males with six-segmented antennae, flabella on the third through fourth segments. Vertex, frons, and clypeus fused to form one sclerite. Mandibles robust, crossed, curved inward apically. Maxilla with single palpus. Simple pro- and mesosternum. Metacoxae not fused medially. Tarsi five-segmented, without sensory spots, with single pair of claws. Wing with MA₁ elongated and sturdy. Aedeagus relatively straight, with pointed apex (Hofeneder 1910; Kinzelbach 1970; Kathirithamby 1989).

Females are free-living as adults. Head with three- to four-segmented antennae. Tarsi two to three segmented, with claws. Single genital pore on seventh abdominal segment (Silvestri 1933, 1943; Kinzelbach 1970; Kathirithamby 1989).

First instar larvae of *Mengenilla* share one apomorphy with other known Men-

genillidae, fused abdominal segments nine and ten, which separates them from species of other families (Pohl 2002).

Identification keys.—Identification keys were published previously by Silvestri (1941b, 1943); Kinzelbach (1979); and Kifune and Hirashima (1980). The following key utilizes some of the same characters, but some previously used characters (such as total length) proved to be unreliable with the discovery of new specimens. Figs. 3, 5, and 6 illustrate the aedeagus, mandible, and maxilla, respectively, of most species. However, caution should be used in relying solely on these single characters for identification because there is variation and they are often difficult to properly view in some specimens.

KEY TO SPECIES OF *MENGENILLA*

- 1. Antennae relatively short (less than 2 times head length); flabella somewhat rounded (Fig. 2C and 4A) 2
- Antennae relatively long (greater than 2 times head length); flabella somewhat pointed (Fig. 2D and 4B) 5
- 2. Anterior of head concave, with antennae appearing to attach to the front of the head (Fig. 4A); Sri Lanka *M. orientalis*
- Antennae of head convex or transverse, antennae not appearing to attach to the front of the head (Fig. 2A) 3
- 3. R₂ of hind wing close to and appearing almost in line with R₁, not halfway between R₁ and R₃ (Fig. 1A) 4
- R₂ of hind wing approximately halfway between R₁ and R₃ (Fig. 1C); Kazakhstan *M. marikovskii*
- 4. Eye with around 30 facets; maxillae with pronounced lappet (Fig. 6B); Australia *M. australiensis*
- Eye with around 60 facets; maxillae with a small lappet at most (Fig. 6I); China *M. sinensis*
- 5. Eye distinctly two toned, dorsal region of eye white to light tan, rest of eye brown; Madagascar *Mengenilla leucomma*, n. sp.
- Eye uniformly colored, usually brown to yellow brown 6
- 6. Eye with less than 30 facets; maxilla without lappet; aedeagus with somewhat bulbous base (Fig. 3E); Australia *M. gracilipes*

- Eye with more than 30 facets; maxilla with or without a lappet; aedeagus with or without a bulbous base 7
- 7. Total length less than 3 mm; eye with less than 40 facets; maxilla without a conspicuous lappet (Fig. 6H), mandible broad at base, apical 1/3 without microtrichia (Fig. 5H); Italy (Sicily) *M. parvula*
- Not matching all the above characters 8
- 8. Anterior of head narrowed, with antennae appearing to emerge between eyes and anterior end (Fig. 2B); eyes protruding from sides of head 9
- Anterior of head rounded, antennae appearing to be attached near anterior margin; Eyes only slightly protruding from head; Algeria, Morocco, Italy, Spain, Portugal, Malta *M. chobauti*
- 9. Microtrichia extending almost to tip of mandible and 4 times as long as wide (Fig. 5C); Saudi Arabia *M. arabica*
- Microtrichia extending about half way to tip of mandible and more than 4 times as long as wide (Fig. 5D); Mongolia. *M. kaszabi*

SPECIES OF *MENGENILLA*

Mengenilla arabica Kinzelbach 1979 (Figs. 3A, 5A, 6A)

Mengenilla arabica Kinzelbach 1979: 331.

Kinzelbach described *M. arabica* from one male collected in 1977 by Dr W. Büttiker in Jeddah, Saudi Arabia (labeled as Dschidda, German for Jeddah). The holotype (examined) is deposited in Naturhistorisches Museum Basel (Bearbeitungs – Nr. 1187), and is slide-mounted in Canadian balsam. This specimen is 2.8 mm in total length. The mandible is narrow, approximately 155 µm, and is covered with microtrichia except for a distal portion, which is lightly sclerotized (Fig. 5A). The maxilla is covered with microtrichia; the palp, which appears as a second segment, is not attached to the apical end of the fused cardo and stipes (first segment), thus forming a lappet (Kifune and Hirashima 1980) and the length of the basal segment (70 µm) is slightly shorter than that of the second segment (95 µm)

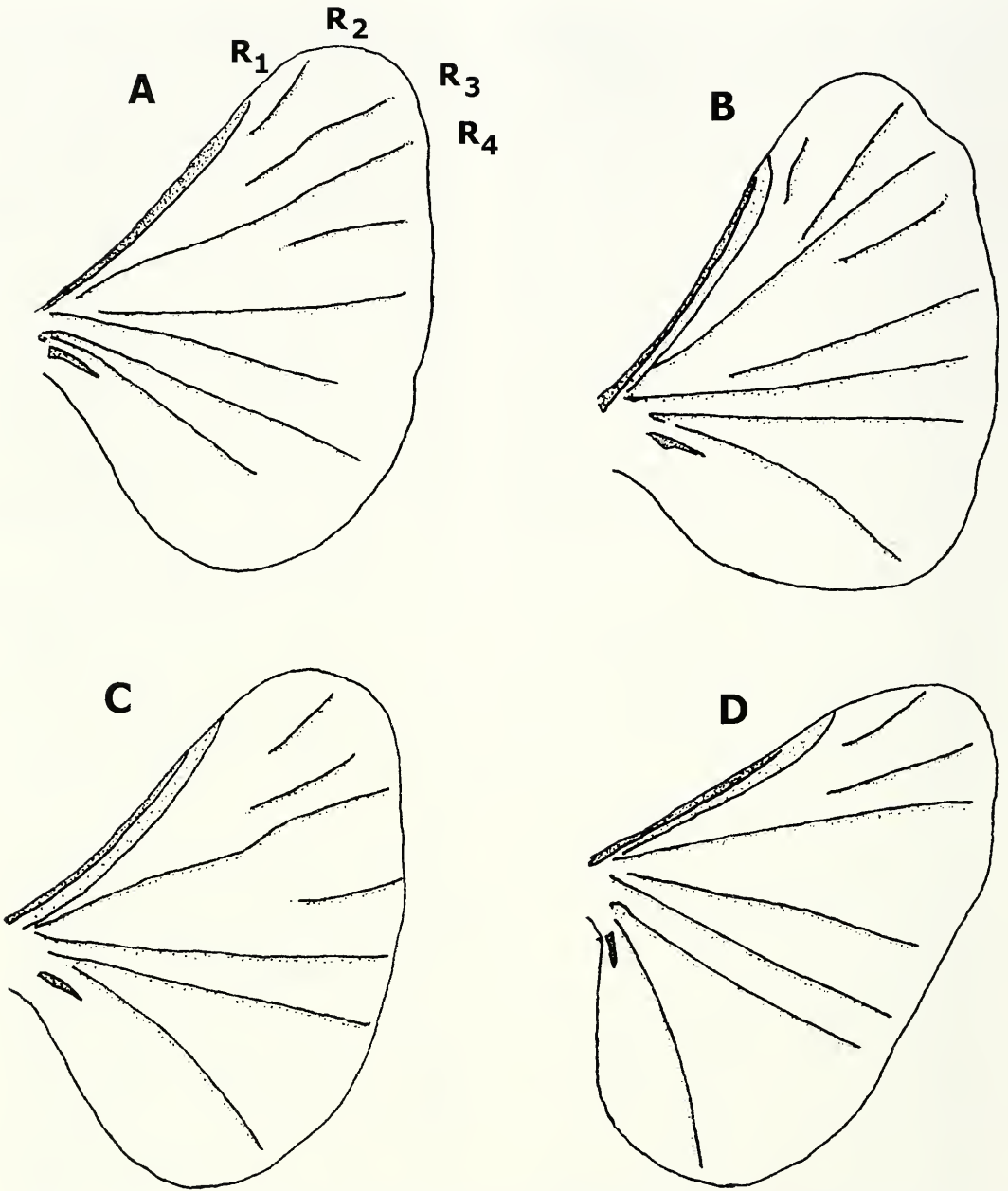


Fig. 1. Wings. A, *Mengenilla australiensis* (redrawn after Kifune and Hirashima 1983). B, *M. kaszabi* (redrawn after Kinzelbach 1971). C, *M. marikovskii* (redrawn after Medvedev 1970). D, *M. chobauti*.

(Fig. 6A). However, the lappet can easily go unnoticed if viewed from the wrong angle. The eyes of the holotype have 38 ± 1 ommatidia. The antennae have all flabella terminating at about an equal distance from the antennal base, and

a sensory spot (Hofeneder organ) near the base of the second flabellum (segment IV). All flabella are approximately equal in length. The antenna is approximately $480 \mu\text{m}$. The aedeagus is relatively thick, tapering, but not bulbous at

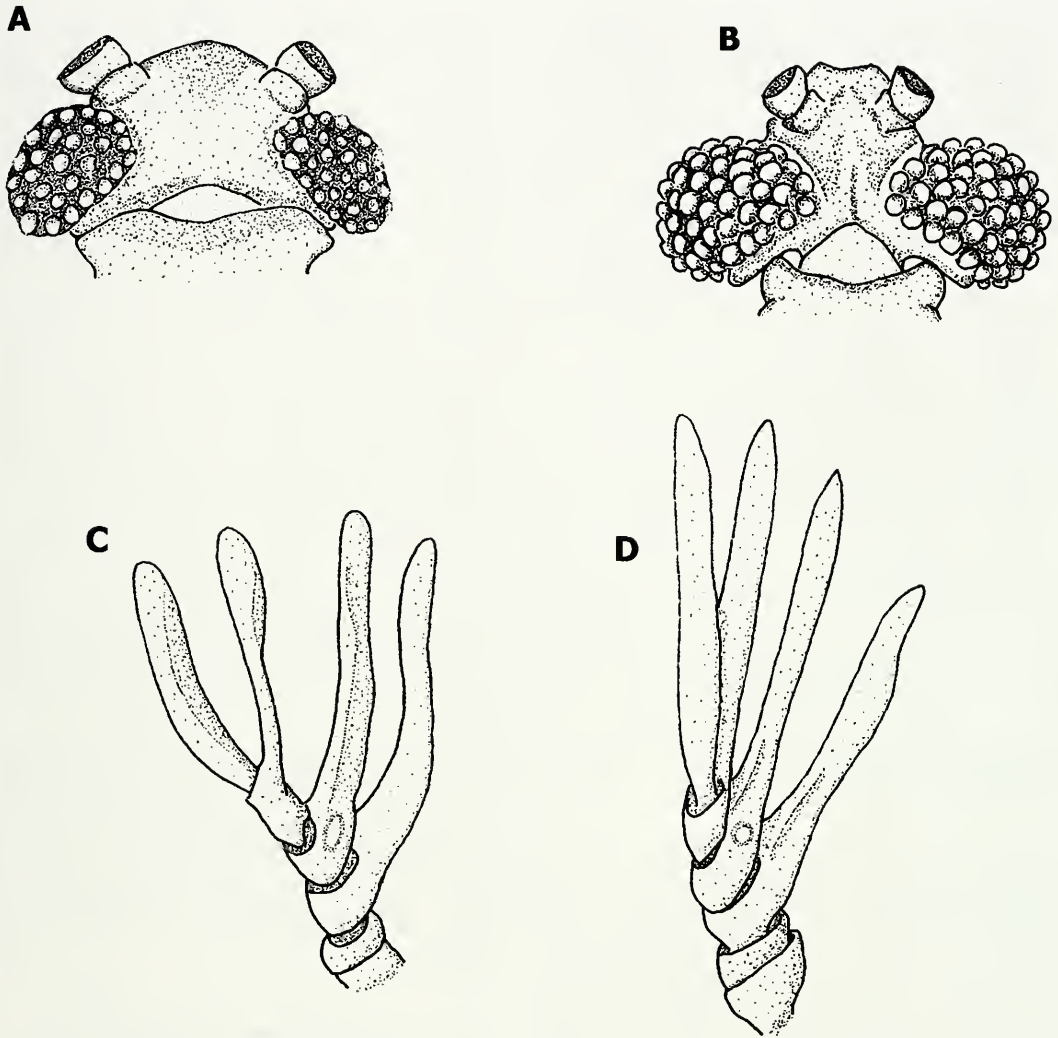


Fig. 2. Heads, with antennal segments III-VI removed. A, *Mengenilla australiensis*. B, *M. kaszabi*. Antennae. C, *Mengenilla australiensis* (redrawn after Kifune and Hirashima 1983). D, *M. kaszabi* (redrawn after Kinzelbach 1971).

the base (Fig. 3A), and is about 140 μm in length. Illustrations of the thorax and legs are found in Kinzelbach (1979).

Additional male specimens have been collected since the original description. I examined three additional specimens collected in Saudi Arabia that are deposited in Naturhistorisches Museum Basel, one of which has been noted by Kinzelbach (1980). These differed from the holotype primarily in size, ranging from 3.0 to 3.4 mm, and in number of

ommatidia, all being around 50. All were collected in Saudi Arabia (Wadi Turabah camp 2, 7-18 X 1979, W. Büttiker; Hofuf, 5 XII 1982, A. S. Talhouk; Fifa, 1 IV 1983, A. S. Talhouk). Additionally, Al-Houty (1989) reports the collection of six additional males collected from Sulabiya, Saudi Arabia in 1983, but does not give any physical description or deposition location of specimens.

Knowledge of the variation of male characters in light of the additional

known specimens makes the keys by Kinzelbach (1979) and Kifune and Hirashima (1980) obsolete. These keys utilized size as the first deciding characteristic, dividing species into those less than 3 mm and more than 3 mm. The addition specimens of *M. arabica* currently establishes a known range of 2.8 to 3.4 mm. Size may be highly variable in this species and throughout the genus, and is probably not a good character by which to define species.

The female, larvae, and host of *M. arabica* are unknown. Kinzelbach (1979) questioned whether this species was using *Ctenolepisma* as a host species, as other *Mengenilla* whose hosts are known, due to the arid habitat type around Jeddah, Saudi Arabia.

Mengenilla australiensis Kifune and
Hirashima 1983

(Figs. 1A, 2A, 3B, 5B, 6B)

Mengenilla australiensis Kifune and Hirashima 1983: 157.

Kifune and Hirashima described *M. australiensis* from two specimens collected at blacklight by G. F. Hevel and J. A. Fortin and deposited the Smithsonian Institution, National Museum of Natural History, Department of Entomology (examined). The type locality is 8 km north of Kulgera, N. T., Australia. The type and paratype are 3.14 and 3.10 mm respectively. Total length is between 3.10 and 3.14 mm. The head is somewhat different than the normal trapezoidal shape found in most members of the genus (Fig. 2A). The anterior of the head, between antennal segments, is convex and the distance between the eyes is relatively large (250 μ m space between eyes, head width at eyes is approximately 730 μ m). The eyes have approximately 60 ommatidia. The flabella of the antennae protrude about an equal distance away from the base of the antennae, making the third flabellum

(antennal segment V) shorter than the other two. The Hofeneder organ is present on the inside of the second flabellum (antennal segment IV). The mandible is 400 μ m and covered with microtrichia except at the apex. (Fig. 5B). The maxillary palp forms a lappet, but is relatively close to the apex of the fused cardo and stipes (1st segment), both segments are approximately equal in length (about 330 μ m), and both segments are covered with microtrichia (Fig. 6B). The sclerite of the labrum is free as noted by Beutel and Pohl (2006), but it is very difficult to distinguish with a dissecting microscope. The prothorax has a pronounced concave anterior margin and is slightly narrower than the mesothorax. The aedeagus is slightly curved and bulbous at the base (Fig. 3B). Line drawings were provided by Kifune and Hirashima (1983).

The female and host are unknown. This is one of two species known from Australia, however Reik (1970) stated that members of this family are widespread, and at least eight species exist. I have not seen specimens to validate this statement.

Mengenilla chobauti Hofeneder 1910
(Figs. 1D, 3C, 5C, 6C)

Mengenilla chobauti Hofeneder 1910: 34.
Tetrozocera santchii Pierce 1918: 429.

Mengenillopsis theryi Hofeneder 1926: 56.

Mengenillopsis mauretanicus Hofeneder 1928: 195.

Mengenilla quaesita Silvestri 1933: 2.

Mengenilla spinulosa Silvestri 1940: 614.

Mengenilla nigritula Silvestri 1941b: 58.

Mengenilla subnigrescens Silvestri 1941b: 58.

Mengenilla laevigata Silvestri 1941b: 58.

Mengenilla nigritula quadriarticulata Luna de Carvalho 1953: 2.

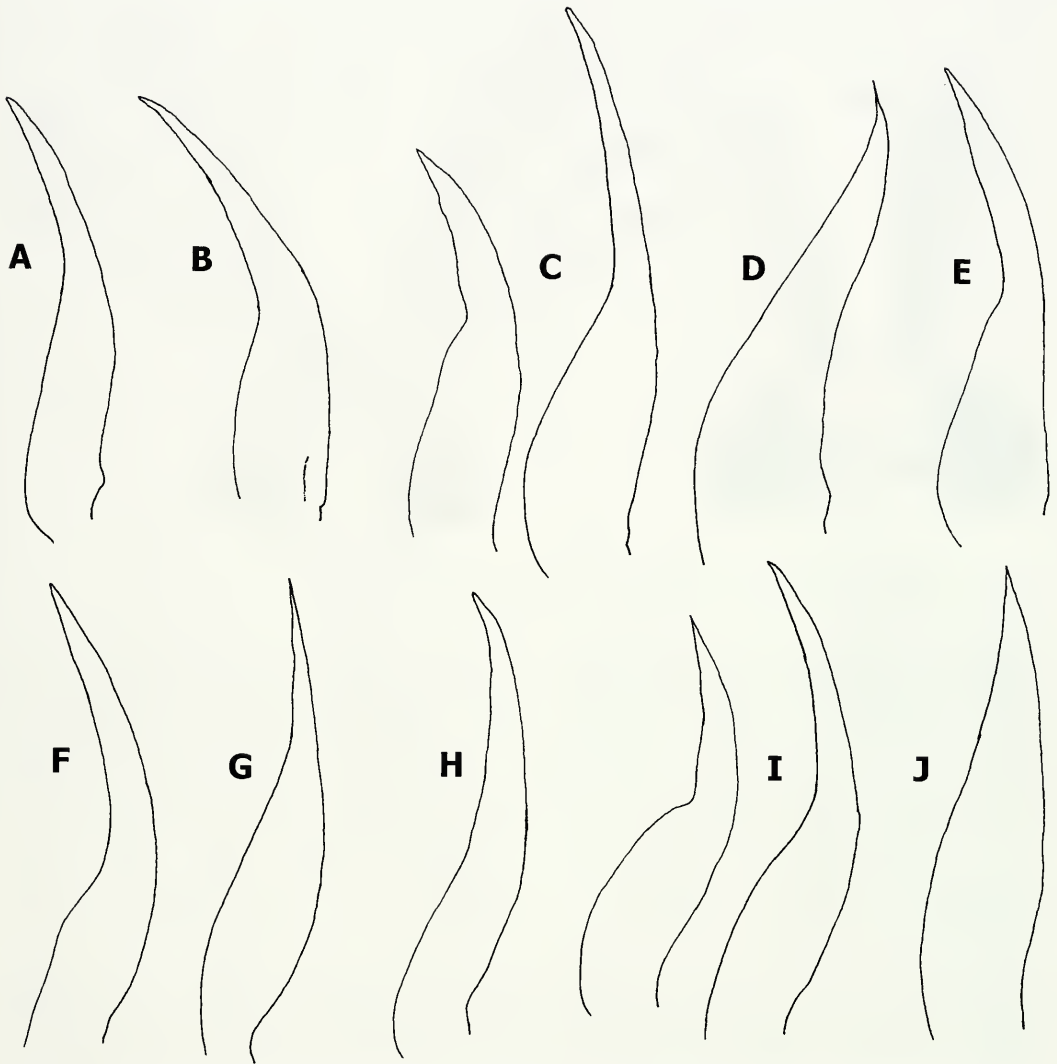


Fig. 3. General shape of the aedeagus. A, *Mengenilla arabica* (redrawn after Kinzelbach 1979). B, *M. australiensis*. C, *M. chobauti* (redrawn after Kinzelbach 1971). D, *M. gracilipes* (redrawn after Kinzelbach 1971). E, *M. kaszabi* (redrawn after Kinzelbach 1971). F, *M. leucomma*. G, *Mengenilla marikovskii* (redrawn after Medvedev 1970). H, *M. orientalis* (redrawn after Kifune and Hirashima 1980). I, *M. parvula* (redrawn after Kinzelbach 1971). J, *M. sinensis* (redrawn after Miyamoto 1960 and Kinzelbach 1971). Note that there is variability within species and some figures represent an average shape for each species; where large variation is known two figures are illustrated to show the range in variation.

Hofeneder (1910) described *M. chobauti* from material collected by A. Chobaut in Algeria. The holotype (not observed) was originally kept in the collection of A. Chobaut and is now probably in Muséum d'Histoire Naturelle, Paris (Kinzelbach 1970). Subsequently, eight species and one subspecies

have been named and later declared junior synonyms of *M. chobauti*. Pierce (1918) described *Tetrozocera santchii* from a single male collected by F. Santchi in Tunisia. The specimen varies from others only by having a high number of ommatidia (80–90). This specimen is deposited in the Smithsonian

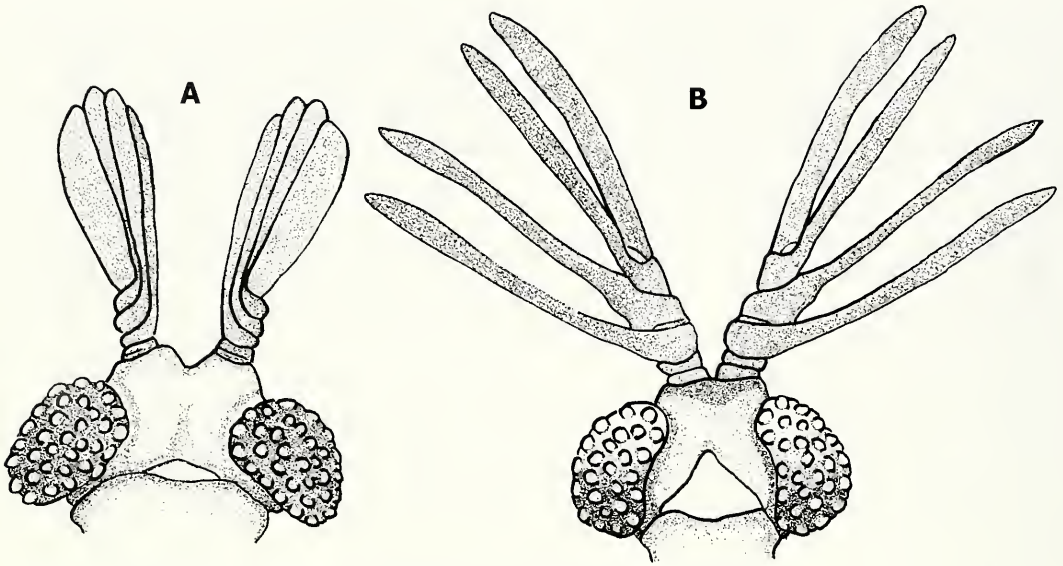


Fig. 4. Dorsal view of head. A, *Mingenilla orientalis*. B, *M. leucomma*.

Institution, National Museum of Natural History (USNM No. 21434). Silvestri (1933) noted that *T. santchii* was probably the same as *M. chobauti*, but in 1943 still listed it as a valid species, although in the genus *Mingenilla* (Silvestri 1943). It was finally synonymized with *M. chobauti* by Kinzelbach (1970). After describing *M. chobauti*, Hofeneder described two more species that were later synonymized with *M. chobauti*. *Mengenillopsis theryi* was collected by Dr. A. Théry in Rabat, Morocco in July 1923 and later named by Hofeneder (1926). The holotype is in The Natural History Museum, London. An addition specimen was collected in July 1930 by H. Riser in southern Spain and identified by Hofeneder (Kinzelbach 1970). This dried specimen is deposited in Naturhistorisches Museum Wien. *Mengenillopsis mauretanicus* was named two years later by Hofeneder (1928) from six specimens that were also collected by Dr. A. Théry in Rabat, Morocco, in 1923. Both species were moved to *Mingenilla* by Silvestri (1943) and were later synonymized by Kinzelbach (1970), who considered the differences in the specimens within the

variation found in *M. chobauti*. Two characters that do fall at the extreme of the variation known for *M. chobauti* is the small size of the *M. theryi* type, which was 2.6–2.8 mm, and the large lappet found in the maxilla of *M. mauretanicus* (illustrated by Kinzelbach (1970)). Silvestri (1933, 1940, 1941b) described five species that were later synonymized by Kinzelbach. Types were not designated by Silvestri, but I examined his collection, which are presumably the specimens used to describe his species. They are deposited in Dipartimento di Entomologia e Zoologia Agraria, Università di Napoli Federico II, Portici, Italy. *Mingenilla quaesita* was described from males and females collected from Pisciotta, Salerno, Italy (Silvestri 1933). *Mingenilla spinulosa* was described from Sicily (Silvestri 1940). *Mingenilla nigritula*, *M. subnigrescens*, and *M. laevigata* were described from Puglia, Italy; Palermo, Sicily, Italy; and Cosenza, Italy, respectively. These species were described from male, female, and larval specimens and were reported by Silvestri (1941b) to all use *Ctenolepisma ciliata* as a host. The

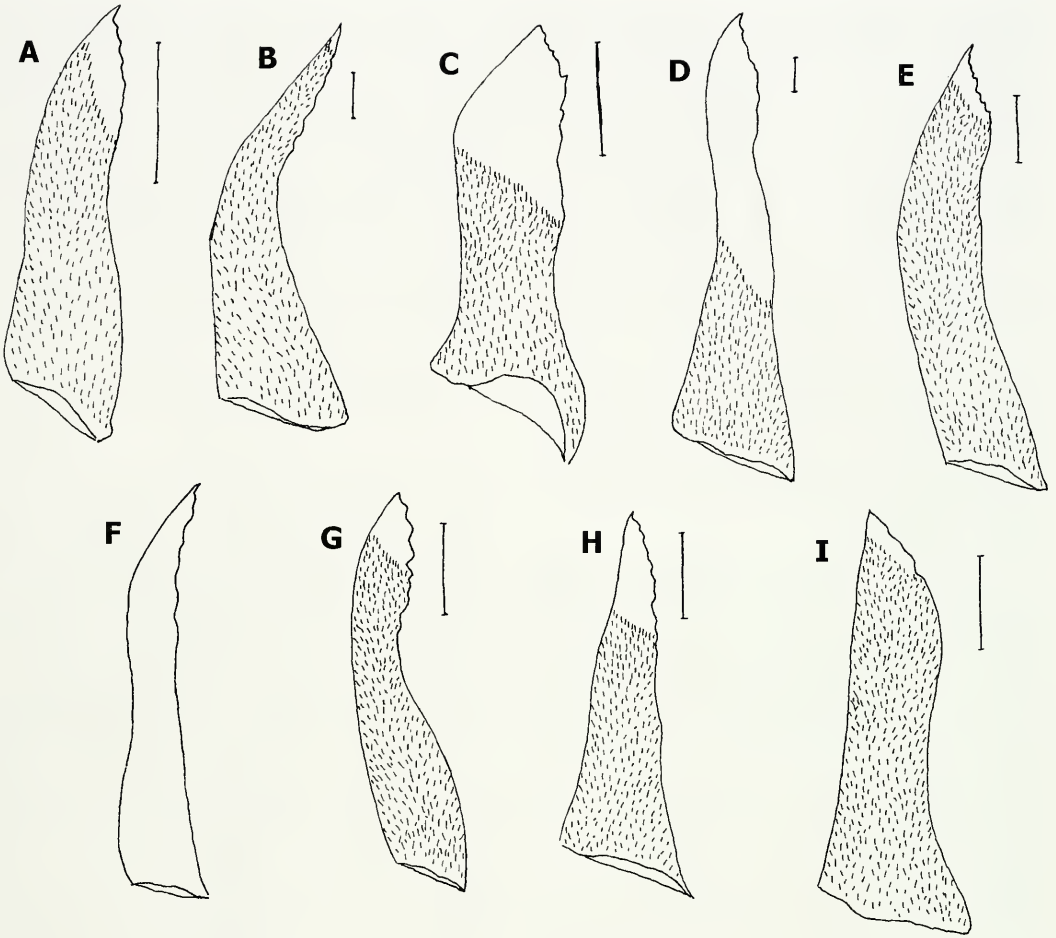


Fig. 5. Mandibles. A, *Mengenilla arabica*. B, *M. australiensis*, C, *M. chobauti* (redrawn after Kinzelbach 1971). D, *M. kaszabi* (redrawn after Kinzelbach 1971). E, *M. leucomma*. F, *M. marikovskii* (covering of microtrichia is unknown) (redrawn after Medvedev 1970). G, *M. orientalis*. H, *M. parvula* (redrawn after Kinzelbach 1971). I, *M. sinensis* (redrawn after Miyamoto 1960 and Kinzelbach 1971). Scale bars are all 50 μ .

common host use and overlap of many characters with *M. chobauti* led Kinzelbach (1970) to synonymize these species. Luna de Carvalho (1953) described what he thought was a new subspecies of *M. nigritula* as *M. nigritula quadriarticulata* primarily because the female specimen he collected had four antennal segments instead of the three reported by Silvestri (1941a, 1943). This subspecies was also synonymized by Kinzelbach (1970). The result of including all of these specimens as *M. chobauti* is that it constitutes

a species with a considerable amount of variation, if it is indeed one species. I concur with Kinzelbach (1970) that the above five species named by Silvestri should currently be included as *M. chobauti*. However, each of Silvestri's species are consistent in their characters as he described them and may constitute distinct species that simply utilize the same host species. I examined between five and ten specimens of each of the five Silvestri named species (including types) and within each of these there is little

variation. Still, they are most likely local variations of the same species. The specimens that were originally placed in *Mengenillopsis* by Hofeneder (1926, 1928) are somewhat more questionable because they show extremes not found in other specimens of *M. chobauti*. The obvious resolution to this problem would be to use molecular techniques to compare specimens, but unfortunately there are no specimens available for this analysis. A future analysis may reinstate one or more of these species, or confirm that they are all *M. chobauti*. Until this information is available, Kinzelbach's classification appears to be the most logical to follow.

Mengenilla chobauti ranges in size from 2.6 to 5.9 mm, although the only specimen known that are less than 4.0 mm is the specimen that was originally described by Hofeneder (1928) as *M. theryi*. The number of ommatidia ranges from 35 to 80. All flabella lengths are approximately equal, and a Hofeneder's organ is found at the base of the second flabellum (fourth antennal segment). The mandible is somewhat variable between known specimens, as is the amount of microtrichia on the mandible (Fig. 5C) (mandible variation is illustrated by Kinzelbach 1970). The maxillary palp also exhibits some variation, but in general the maxilla has a small lappet of the cardio-stipes with the palp (Fig. 6C). The aedeagus is variable, ranging from somewhat uniformly tapered to bulbous.

Mengenilla chobauti is one of the two species whose female, larva, and host are known. The female of this species is larviform, but free living. The antennae are reported as either three or four segmented (Silvestri 1933, 1934; Luna de Carvalho 1953). The first two antennal segments (when there are four antennal segments) are subequal in length and much shorter than the terminal two antennal segments. There are between 12 and 25 ommatidia in each

eye, and mandibles and maxillae are small, but visible. Like males, the female maxilla has a one-segmented palp, with the basal cardo and stipes making the maxilla look like a two-segmented structure. Wings are absent, but legs with three tarsal segments are present. There is one genital pore on the seventh abdominal segment. The female, first instar larvae, and pupa of *M. chobauti* were illustrated by Silvestri (1933, 1943).

Mengenilla gracilipes (Lea 1910)
(Figs. 3E, 6D)

Austrostylops gracilipes Lea 1910: 515.

Lea (1910) collected "a number of specimens" in 1895 from Bridgetown, W. Australia, and these were later described as *Austrostylops gracilipes*. A slide mounted type specimen labeled "cotype" is in The Natural History Museum, London. The habitus of *A. gracilipes* was originally illustrated by Lea and later redrawn by Pierce (1918) and Silvestri (1946). The species was placed in *Mengenilla* by Silvestri (1946). The original length of this species was given by Lea as approximately 2.5 mm, but more accurately reported by Kinzelbach (1970) as 2.8 mm. *Mengenilla gracilipes* has eyes with between 25 and 27 ommatidia. The maxilla, including the palp, is covered with microtrichia; without a lappet, and the apical segment is longer (220 μm) than the basal segment (130 μm) (Fig. 6D). A free labrum is reported to be present in all Australian *Mengenilla* (Beutel and Pohl 2006), but I was not able to confirm its presence in *M. gracilipes*. Antennae have flabella on the fourth and fifth segments that extend further from the antennal base than do the third and sixth. There is a Hofeneder's organ at the base of the fourth segment. The aedeagus tapers gradually, and is slightly bulbous at its base (Fig. 3E). The female, larvae, and host are unknown.

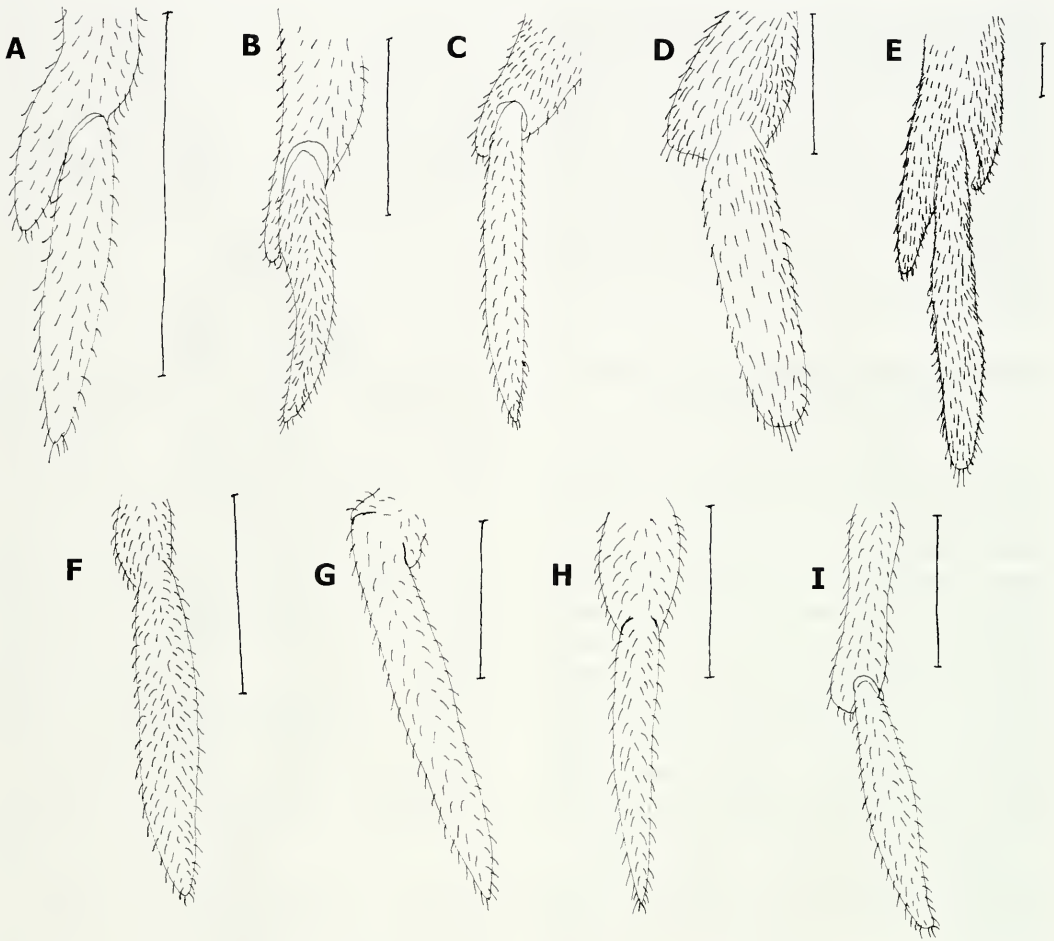


Fig. 6. Maxillae. A, *Mengenilla arabica*. B, *M. australiensis*. C, *M. chobauti*. D, *M. gracilipes* (redrawn after Kinzelbach 1971). E, *M. kaszabi* (redrawn after Kinzelbach 1971). F, *M. leucomma*. G, *M. orientalis*. H, *M. parvula*. I, *M. sinensis* (redrawn after Miyamoto 1960 and Kinzelbach 1971). Scale bars are all 100 μ .

Mengenilla kaszabi Kinzelbach 1970
(Figs. 1B, 2B, 2D, 3F, 5D, 6D)

Mengenilla kaszabi Kinzelbach 1970:
227.

Mengenilla kaszabi was described from a series (79 males) of specimens that were collected by Dr. Z. Kaszabi at lights at the Echin Oasis, Bayankongor Aimag (Province), Mongolia. A holotype and five paratypes are deposited in the Hungarian Natural History Museum, Budapest.

The adult males have a known size range of 3.2 to 5.1 mm. The head is somewhat square anteriorly, between the antennae, and the distance between the eyes is less than the dorsal eye diameter (Fig. 2B). The mandible is relatively long (~0.7 mm) with microtrichia on the basal half (Fig. 5D). The maxilla is covered with microtrichia, has a lappet, and the palp is slightly longer (530 μ m) than the basal maxillary segment (430 μ m) (Fig. 6D). The eyes have between 45 and 65 ommatidia. Flabella on

segments 4 and 5 extend slightly beyond those of segments 3 and 6, and the flabellum of segment 4 has a small Hoffeneder's organ at its base. The fragmented R_2 wing vein is near (almost touching) R_1 (Fig. 1B). The aedeagus is slightly bulbous at the base (Fig. 3F). Kinzelbach (1971: 256) provides a detailed habitus. The female, larva, and host are unknown.

Mengenilla leucomma Cook, new species
(Figs. 3G, 4B, 5E, 6F, 9)

The description of this new species is based on five male specimens collected by Fisher, Griswold, et al. from Reserve Spéciale d'Ambre (3.5 km SW of Sakaramy), Province d'Antstranana, Madagascar. The specimens were all collected between January 26–31, 2001 by Malaise trap in tropical dry forest at an elevation of 325 m. The female, larval stages, and host are unknown. The following description is of the holotype with variation or range of paratypes in parenthesis:

Description.—*Body*: Total length = 2.6 mm (2.4–2.8 mm). Head + thorax length = 1.6 mm (1.6–1.8 mm). Thorax breadth = 0.57 mm (0.53–0.59 mm). Color mostly light brown, with dark brown markings on some sclerites (Fig. 8). Head dark brown except for cream-colored to white anterior dorsal region of the eyes.

Head: Roughly trapezoidal, with anterior edge straight and posterior edge deeply concave. General head capsule shape as in Fig. 4B. Number of facets in eye approximately 50, about half of which visible in dorsal view. Anterior facets white, with facets becoming darker posteriorly. Area of eye surrounding facets with color pattern corresponding to color of facets. Flabella on segments III–V relatively long and slender (Fig. 4B), all with sensilla. Segments III–VI extending about an equal distance away from head. Antennal segment IV

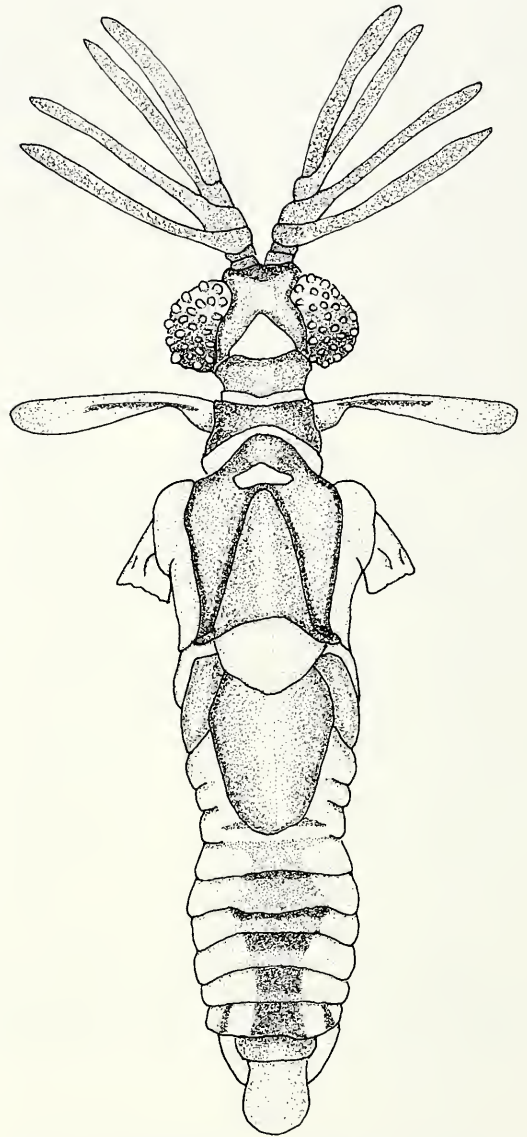


Fig. 7. Habitus, minus appendages, of *Mengenilla leucomma*.

with a ventral Hofeneder's organ at base of flabellum. Mandible about 335 μ , somewhat curved inward, with microtrichia (only seen at high magnification) except at apex (Fig. 5). Maxillary palp attached to end of fused cardo and stipes, not forming a lappet; covered with microtrichia; fused cardo and stipes ($< 50 \mu$) much shorter than palp (170 μ) (Fig. 6F).

Thorax: Dorsal sclerites as in Fig. 8. Wing with R_2 closer to R_1 than to R_3 . R_3 short, subequal in length to R_2 . R_5 , MA_1 , MA_2 , and Cu_1 extending to near wing margin (Fig. 8). Measurements (microns) for prothoracic, mesothoracic, and metathoracic legs respectively: femur 290, 280, 415; tibia 320,320,330; tarsi (proximal to distal) (180, 105, 90, 80, 105), (150, 85, 85, 60, 85), (225, 135, 105, 85, 120) (Fig. 9). Hind trochanter as shown in Fig. 9. Aedeagus 225 μ , slightly bulbous at base, curved, tapering to point (Fig. 3G).

Holotype.—Male is deposited in the California Academy of Sciences, San Francisco. Label information as follows: Madagascar: Province d'Antsirana, Réserve Spéciale d'Ambre, 3.5 km 235°SW Sakaramy, 325 m, 26–31 Jan. 2001 m 12°28'8"S 49°14'32"E, coll. Fisher, Griswold et al., Calif. Acad. of Sciences, Malaise trap in tropical dry forest, Coll. code BLF 2661.

Paratypes.—Four male paratypes deposited in the California Academy of Sciences, San Francisco. Collection data same as holotype

Etymology.—The specific epithet is a Greek derivative meaning white eyes. This refers to the anterior dorsal portion of the eyes that are white, changing to tan, and then brown posteriorly. All known specimens have this character, which is not found in other species in this genus.

Discussion.—*Mengenilla leucomma* most closely resembles *M. orientalis* except for the pale eye coloration described above, having an anterior region of the head straight instead of concave, and antennae that are relatively long and slender as illustrated in Fig. 4. I viewed one specimen of *M. arabica* that has an eye pattern similar to *M. leucoma*, but not nearly as pronounced. The wing venation of *M. leucomma* closely resembles *M. australiensis*, but there are distinct differences, such as the length of R_3 (Figs. 2A, 8). The aedeagus of all *Men-*

genilla species are slightly curved and tapering to a point. Most species have a bulbous base of various size. While the aedeagus is distinctive between species, there is also variation, as illustrated by *M. chobauti*'s considerable variation (Fig. 3C) and in the slight variation in the aedeagus base of *M. parvula* (Fig. 3J). However, it is possible that *M. chobauti* could be a species complex, thus accounting for the perceived large variability now recognized within this species. The aedeagus of *M. leucomma* varies slightly from all other *Mengenilla* species (Fig. 3). Mandibles of *Mengenilla* species probably constitute good species characters, but are sometimes difficult to view. Mandibles are curved inward to some extent in all species, and have distinctive shapes and patterns of microtrichia, which requires a compound microscope to view. Differences between *M. leucomma* and other species is illustrated in Fig. 5. The maxillae are the easiest of the mouthparts to observe in specimens and can usually be viewed with a dissecting microscope. The maxilla of all *Mengenilla* species consist of a basal segment that represents a fused cardo and stipes, and an apical single palp segment. The lengths of these maxillary structures and the length comparison of the two segments appears to be a good taxonomic character. Additionally, some species have a distinct lappet formed by the apical end of the basal segment extending beyond the base of the apical, palp segment. *Mengenilla leucomma* has no lappet and has a very short basal segment in relation to its maxillary palp (Fig. 6).

Mengenilla marikovskii Medvedev 1970
(Figs. 1C, 3H, 5F)

Mengenilla marikovskii Medvedev 1970:
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Mengenilla marikovskii was described from two males collected in southeastern Kazakhstan by P. I. Marikovskiy and T.

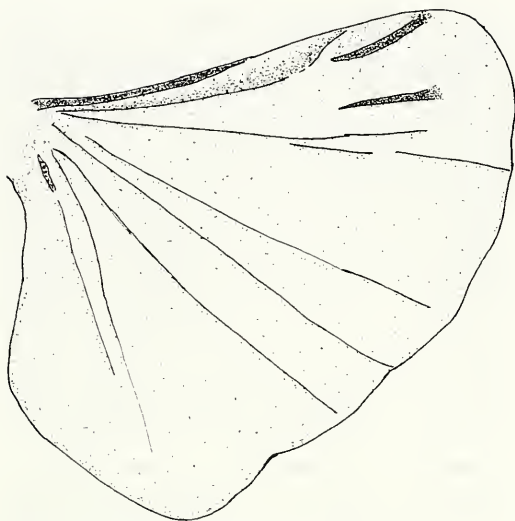


Fig. 8. Wing of *Mengeniella leucomma*.

P. Marikovskaya on May 8, 1962. These specimens (not examined) are deposited in the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

Males are 3.6 mm in length. Mandibles are relatively narrow (Fig. 5F); structure of the maxillae is unknown. Flabella of all segments are approximately equal in length. R_2 of the hind wing is located almost half way between R_1 and R_3 (Fig. 1C). The aedeagus is only slightly bulbous at its base (Fig. 3H). Figures were provided by Medvedev (1970), but are lacking in detail. The host, female, and larvae are unknown.

Mengeniella orientalis Kifune and
Hirashima 1980
(3I, 4A, 5G, 6G)

Mengeniella orientalis Kifune and Hirashima 1980: 144.

Mengeniella orientalis was named from a male specimen collected at a black light by G. F. Hevel, R. E. Dietz IV, S. Kuranaratne, and D. W. Balasooriya from Olatithoduvai (10 miles NW of Mannar), Sri Lanka on Nov. 4–5, 1976.

The holotype (observed) is deposited in alcohol in the Smithsonian Institution, National Museum of Natural History (USNM 76712).

The holotype male is 2.6 mm in total length. The maxillary palp is much longer ($\sim 220 \mu\text{m}$) than the basal segment of the maxilla ($\sim 20 \mu\text{m}$) (Fig. 6G). No lappet is formed by the maxilla. The mandible is about $220 \mu\text{m}$ long and covered with microtricha except at the apical tip (Fig. 5G). The antennae are relatively short ($600 \mu\text{m}$), with thick flabella (Fig. 4A). The flabella on segments 4 and 5 extend slightly further than do those on segments 3 and 6. The fourth antennal segment has a large Hoffeneder's organ at its base. Each eye has approximately 50 ommatidia. The base of the aedeagus is only slightly thickened (Fig. 3I). The host, female, and larvae are unknown. Only the holotype is known. *Mengeniella orientalis* was illustrated by Kifune and Hirashima (1980).

Mengeniella parvula Silvestri 1941
(Figs. 3J, 5H, 6H)

Mengeniella parvula Silvestri 1941b: 58.

Silvestri described *M. parvula* from specimens collected in 1938 in Carlentini and Lentini, Siracusa Province, Sicily. I did not locate these specimens, but examined specimens collected from the same area in 1939 and identified by Silvestri. These specimens are now in Dipartimento di Entomologia e Zoologia Agraria, Università di Napoli Federico II, Portici, Italy. Adult males, females, first-instar larvae, and pupae are known. The host is *Ctenolepisma michaelsoni*. Adult males range in length from 1.7 to 2.7 mm (measured from the above mentioned specimens collected by Silvestri, and from his published data). Kinzelbach (1970) reported the length of males to be 2.6 mm compared to Silvestri's reported length of 2 mm. The maxilla is

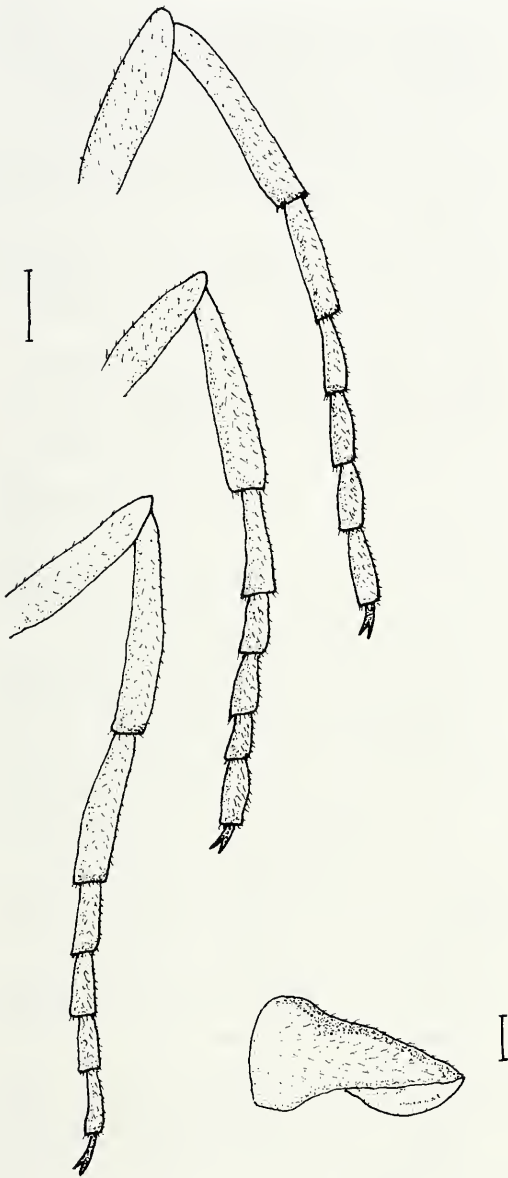


Fig. 9. Leg structures of *Mungenilla leuconma*. A, Femur, tibia, and tarsus (prothoracic leg on top, mesothoracic leg in middle, metathoracic leg on bottom). B, Trochanter of metathoracic leg. Scale bars are both 100 μ .

relatively long and thin, with no lappet. The basal part of the maxilla (0.545 mm) is shorter than the palp (1.744 mm) (Fig. 6H). The mandible is about the same length as the total length of the maxilla, and slightly wider than the

maxilla. Microtrichia cover approximately the basal 2/3 of the mandible (Fig. 5H). The extensions of the flabella are subequal, although in some specimens segments 4 and 5 extend slightly further than 3 and 6. Eyes have 35–40 ommatidia. The aedeagus is bulbous at the base, although there is variation between specimens in the size of the bulb (Figs. 3J).

Adult females are similar to those described for *M. chobauti*, with a few minor exceptions. The eyes have 13 to 15 ommatidia. The antenna in all specimens is four segmented, with the first segment much smaller than the second, both of which are shorter than the subequal third and fourth segments.

Mungenilla sinensis Miyamoto 1960
(Figs. 3L, 5I, 6I)

Mungenilla sinsensis Miyamoto 1960: 37.

Miyamoto named this species based on one male collected by K. Yasumatsu from Shansi Province, North China. The location of the holotype is unknown. The holotype is described by Miyamoto to be generally brown with brown veins in the wings, but the legs are paler towards the apices. The abdomen is pale. The anterior portion of the head between the antennae is convex. Eyes are widely separated (distance between them is about 250 μ m), and the distance between the eyes is greater than the dorsal view eye diameter (210 μ m). Eyes protrude from the side of the head and appear bulging. Each eye has about 60 ommatidia. Antennae are relatively short (about 660 μ m), with the sixth antennal segment shorter than the subequal flabella on segments III–V. The palp has no lappet, and the palp is approximately the same length (120 μ m) as the basal cardo-stipes (Fig. 6I). The mandible (Fig. 5I) is slightly shorter (220 μ m) than the maxillae, with palp (240 μ m). The aedeagus is short and thickened, but not bulbous, at the base (Fig. 3L). Miyamoto

(1960) provided a habitus drawing as well as other line drawings. The female and host are unknown.

ACKNOWLEDGMENTS

I Thank Norm Penny and the California Academy of Sciences for the opportunity to view and describe the Strepsiptera specimens from Madagascar, Cristina Digilio for arranging the loan of Silvestri's *Mengenilla* collections, Gary Hevel for loans from the Smithsonian Institution, Daniel Burckhardt for loans from Natuhistorisches Museum Basel, and Hans Pohl, Universität Rostock, for reprints of two of Silvestri's papers. Collection of the specimens from Madagascar was supported by a grant from the National Science Foundation (DEB-0072713).

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